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(71) Applicant: **ELETTROMECCANICA PARIZZI**  
**S.p.A.**  
Via Glulini 3  
I-20125 Milan(IT)

(72) Inventor: **Fuga, Ferdinando**  
Via Lucania 8  
I-20052 Monza-Milan(IT)  
Inventor: **Farini, Amedeo**  
Via delle Quercie, 37  
I-20090 Rodano-Milan(IT)  
Inventor: **Braga, Alessio**  
Strada Rosmagna, 6  
I-27058 Voghera-Pavia(IT)

(74) Representative: **Henke, Erwin et al**  
**Ing. Barzanò & Zanardo Milano S.p.A.** Via  
Borgonuovo, 10  
I-20121 Milano(IT)

(54) **Wheel-electrical motor assembly for bogies for rail and tram vehicles.**

(57) A wheel-electrical motor assembly for rail and tram vehicles is disclosed, in which to the wheel-hub and to the stationary axle relatively to the bogie, the inductor and the armature of a high-pole-number, synchronous motor are fastened, in order to provide a bogie with distributed drive and reduced overall dimensions

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The present invention relates to a wheel-electrical motor assembly for bogies for rail and tram vehicles.

More particularly, the present invention relates to a wheel-electrical motor assembly for distributed-drive bogies.

Distributed-drive bogies are known, in which independent motors are linked to the wheels by means of relevant reduction gear. Such a structure entails a periodical servicing of the mechanical organs, with time-wasting dismantling and reassembling operations being hence necessary.

Other bogies for rail and tram vehicles are equipped with one single motor which transmits the driving motion to the wheels by means of one pair of reduction gears, but which, owing to their overall height dimensions cannot be used for the lowered-platform cars which have been increasingly used during the past years.

A purpose of the present invention is of providing a wheel-electrical motor assembly which makes it possible, thanks to its smaller overall dimensions, simple and reliable distributed-drive bogies for rail and tram vehicles to be provided.

Another purpose is of reducing the problems connected with the servicing, to a meaningful extent.

In order to achieve such purposes, a wheel-electrical motor assembly for bogies of rail and tram vehicles was developed, in which on a support of said bogie a stationary axle is provided, on which a wheel-hub integral with a tread is rotatably mounted, with shock-absorber means being interposed between said wheel-hub and said tread, which wheel-electrical motor assembly is characterized in that said wheel-hub is contoured, and stably supports the inductor of a permanent-magnet, synchronous motor, with the armature of said motor being fastened onto said stationary axle in order to discharge onto said bogie a reaction torque, with a plate bearing a terminal box being furthermore fastened onto said armature, which terminal box is connected with a power supply/control unit.

In particular, according to the present invention, said inductor and said armature are housed inside a sheltering case fastened onto said armature.

Furthermore, according to a preferred form of practical embodiment, said power supply/control unit is a variable-voltage, variable-frequency inverter unit.

Still according to the present invention, said inductor is fastened onto said wheel-hub by means of a plurality of bolts arranged in ring-like pattern, and is so contoured as to show an outline which is substantially parallel to the contour of said wheel-hub.

The armature of said synchronous motor is fastened onto said stationary axle by means of

bolts.

Furthermore, between said stationary axle and said wheel-hub, thrust bearings are provided.

According to a preferred form of practical embodiment, said permanent-magnet synchronous motor is a large-pole-number motor.

In order to better understand the characteristics and further advantages of the present invention, said invention is disclosed in the following by referring to the accompanying drawing table, in which the single figure shows a partially sectional view of a wheel-electrical motor assembly according to the instant invention.

Referring to the single accompanying figure, a wheel-electrical motor assembly is indicated by the reference numeral 11, and is constituted by an axle 12 fastened onto a bogie (not depicted in the figure), on which axle 12 a wheel-hub 13 is rotatably mounted with the interposition of thrust bearings 14.

Externally to the wheel-hub 13 and coaxially with it, a tread 15 is provided, and, between the latter and the hub a plurality of rubber-made shock absorber means 16 are interposed, to act as primary shock absorber means. Inside the wheel-hub 13 a contoured annular groove 17 is provided, inside which the inductor 18 of a synchronous, large-pole-number motor, generally indicated with the reference numeral 19, is housed.

A portion 20 of the inductor 18 is so contoured, as to have an outline which is approximately parallel to the contoured annular groove 17 of the wheel-hub 13. Said inductor 18 is fastened onto said wheel-hub by means of a plurality of bolts 21, arranged in a ring-like pattern.

On the contrary, the inductor 22 of the synchronous motor 19 is fastened, by means of bolts 23, to the axle 12, thus transmitting the reaction torque to the bogie (not depicted in the figure); on a plate 24 fastened by means of bolts 26 onto the armature 22, a terminal box 25 is provided, by means of which the motor 19 is connected with a power supply/control unit of variable-voltage, variable frequency inverter type. (not depicted in the figure).

The solution proposed according to the present invention displays particular advantages when independent-wheel bogies studied for lowered-platform rail and tram vehicles designed for use in urban networks and tortuous-route railways are taken into consideration.

In particular, according to the present invention, the direct application of the electrical motor onto the wheel is achieved without a reduction gear having to be interposed, thanks to the inductor being accomplished along the perimeter of the electrical machine, thus enabling a larger drive torque to be supplied, with the weight and overall

dimensions being the same as of traditional motors.

The figure evidences the simplicity and reliability of the instant accomplishment, in which the wheel-hub supports the inductor which directly transmits the drive torque, whilst the armature - practically fastened onto the bogie -- discharges onto said bogie the reaction torque, without the aid of bars external to the wheel.

According to the typical form of practical embodiment of the present invention, the electrical motor is a large-pole-number motor, in order to minimize the mass of the magnetic circuit, with the other passive parts of the electrical motor being made from a light alloy, hence contributing to the total mass to a small extent only.

Another special feature of the typical form of practical embodiment is the motor protruding from the wheel contour for a short length only, with advantages as regards the exploitation of the clearance gauge, and also due to the fact that the barycentre 27 of the motor comes to lay in the nearby of the bearings of the wheel.

The absolute absence of mechanical organs amenable to wear is of particular importance, because the independent-wheel bogies are equipped with one motor per each individual wheel, which means a large number of motors per each car with no servicing problems.

The flexibility of the control of the motors enables the bogie to easily enter, and run along, short-radius bends, with the noise caused by the wheel-track friction being consequently reduced.

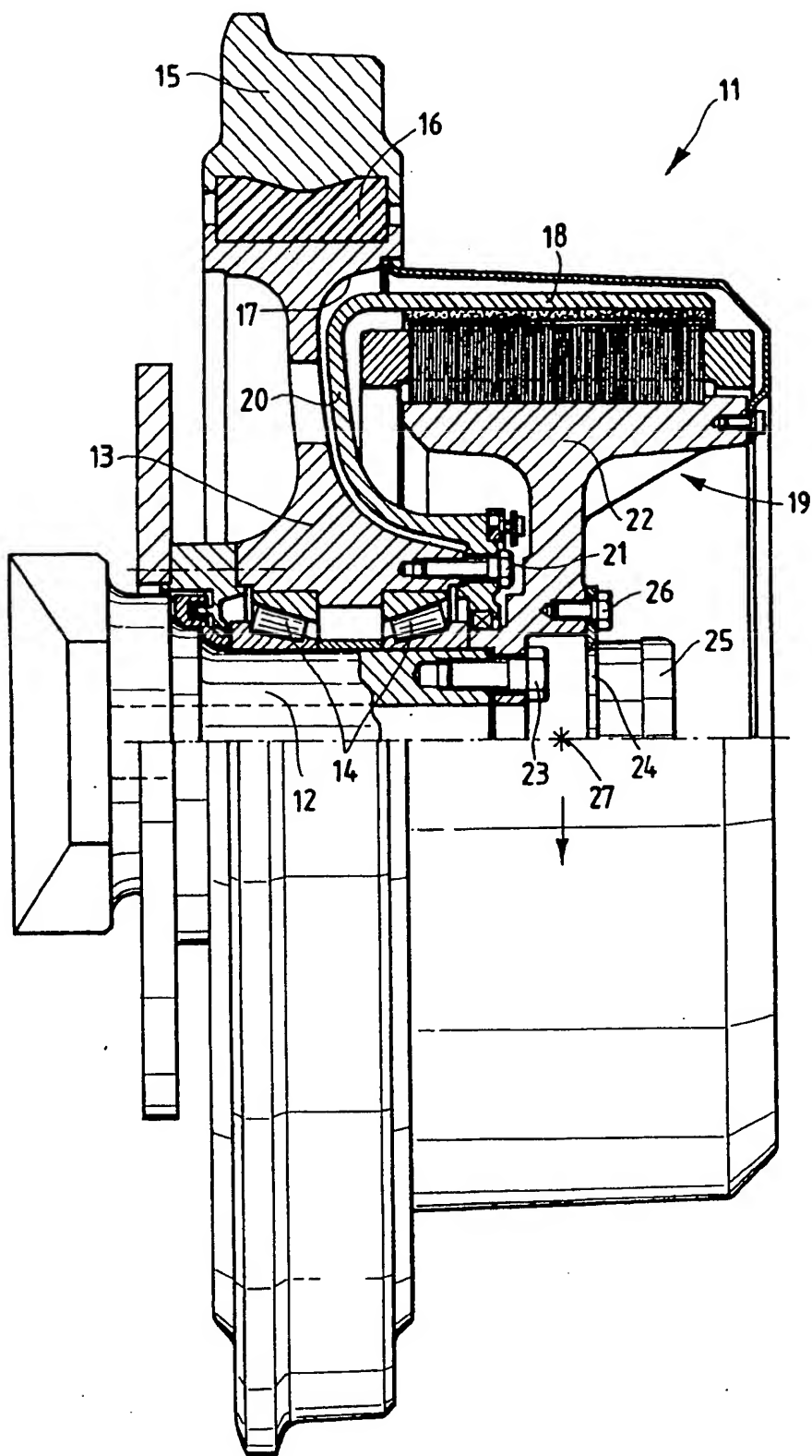
In an application for rail and tram vehicles with distributed drive power, each of said wheel-electrical motor assemblies can be fed by means of one power supply/control unit of inverter type equipped with its own torque/rpm regulator, whilst a central pilot unit is interfaced with the control board and with a number of power supply/control units which equates the number of the available wheel-electrical motors assemblies, with control, supervision, diagnostic and safety tasks.

#### Claims

1. Wheel-electrical motor assembly for bogies for rail and tram vehicles, in which on a support of said bogie a stationary axle is provided, on which a wheel-hub integral with a tread is rotatably mounted, with shock-absorber means being interposed between said wheel-hub and said tread, which wheel-electrical motor assembly is characterized in that said wheel-hub is contoured, and stably supports the inductor of a permanent-magnet, synchronous motor, with the armature of said motor being fastened onto said stationary axle in order to discharge

onto said bogie a reaction torque, with a plate bearing a terminal box being furthermore fastened onto said armature, which terminal box is connected with a power supply/control unit.

2. Wheel-electrical motor assembly according to claim 1, characterized in that said inductor and said armature are housed inside a sheltering case fastened onto said armature.
3. Wheel-electrical motor assembly according to claim 1, characterized in that said power supply/control unit is of variable-voltage, variable-frequency inverter type.
4. Wheel-electrical motor assembly according to claim 1, characterized in that said inductor is fastened onto said wheel-hub by means of a plurality of bolts positioned in a ring-like pattern and is contoured, in order to have an outline which is substantially parallel to the contour of said wheel-hub.
5. Wheel-electrical motor assembly according to claim 1, characterized in that the armature of said synchronous motor is fastened onto said stationary axle by means of bolts.
6. Wheel-electrical motor assembly according to claim 1, characterized in that between said stationary axle and said wheel-hub, thrust bearings are provided.
7. Wheel-electrical motor assembly according to claim 1, characterized in that said permanent-magnet synchronous motor is a large-pole-number motor.





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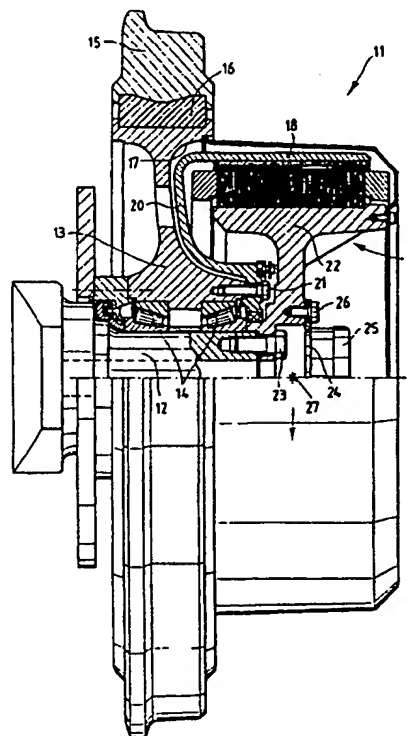
71 Applicant: ELETTRMECCANICA PARIZZI  
S.p.A.  
Via Giulini 3  
I-20125 Milan(IT)

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Via Lucania 8  
I-20052 Monza-Milan(IT)  
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Via delle Quercie, 37  
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Ing.Barzanò & Zanardo Milano S.p.A. Via  
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I-20121 Milano(IT)

54 Wheel-electrical motor assembly for bogies for rail and tram vehicles.

57 A wheel-electrical motor assembly (11) for rail and tram vehicles is disclosed, in which to the wheel-hub (13) and to the stationary axle (12) relatively to the bogie, the inductor (18) and the armature (22) of a high-pole-number, synchronous motor (19) are fastened, in order to provide a bogie with distributed drive and reduced overall dimensions



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## EUROPEAN SEARCH REPORT

Application Number

EP 91 20 1642

### DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 337 032 (NIPPON STEEL CORPORATION ET AL.) * column 1, line 1 - line 4 * * column 6, line 12 - column 7, line 26; figures 3,9 *	1,6,7	B60K7/00 B61C9/46 //B60L15/08
A	DE-A-2 719 736 (F. BURTON) * claim 1; figure 2 *	1,6	
A	US-A-4 585 085 (P. HANDEL ET AL.) * column 3, line 58 - column 4, line 21; figure 3 *	1,6,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B60K B61C
The present search report has been drawn up for all claims			

Place of search  
BERLIN

Date of completion of the search  
12 OCTOBER 1992

Examiner  
WESTERMAYER W.

#### CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone  
Y : particularly relevant if combined with another document of the same category  
A : technological background  
O : non-written disclosure  
P : intermediate document

T : theory or principle underlying the invention  
E : earlier patent document, but published on, or after the filing date  
D : document cited in the application  
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& : member of the same patent family, corresponding document